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Natural and Artificial Conservation of Water Power For Electrical Purposes

By EDWARD R. TAYLOR



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Natural and Artificial Conservation of Water Power For Electrical Purposes.

BY EDWARD R. TAYLOR.

The call of the Governors' Conference by President Roosevelt last May was the inauguration of a development of resources more stupendous than ever before contemplated by any people upon the face of the earth, and it is destined to be of value to our people beyond any present power of computation. Startling facts were arrayed showing the rapid and near-by exhaustion of resources which when once used can never be replaced, and emphasis was placed upon the necessity of utilizing other resources now going to waste which might delay the exhaustion of the unreplaceable.

Of all our resources capable of meeting these exigencies, no other begins to compare with the systematic and perfect development of our water power, and no other so abundantly helps navi-

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gation and commerce without which the marketing of our products, manufactured and otherwise, cannot adequately be performed. Our railroads have admitted their inability to do the work required of them, and even the expenditure of hundreds of millions of dollars would not make them capable of doing what in the nearby future would be required of them, if unaided by water navigation.

I deem myself happy therefore to have been invited by the Franklin Institute to address you to-night on the "Natural and Artificial Conservation of Water Power for Electrical Purposes." These last two words are important, for electricity has made possible the development of water power in one place and its utilization in another, a fact so familiar that I do not need to dwell upon it at this time.

In the conservation of water for power purposes, forests are of great value. They prevent the wearing away of soil so essential to all vegetable growth and by the decay of the fallen leaves add to fertility, and make possible the absorption and retention for a long time the water that would otherwise run quickly away. They also retard the melting of snow in the Spring and thus conserve water for later use. But while the ground is frozen it cannot absorb any more water and unless there are lakes, ponds or reservoirs to receive this water it passes rapidly to the sea, carrying many times devastation in its way, so much so that the annual damage by floods in the United States alone is computed at not less than \$100,000,000.

Forestry alone is incapable of meeting the exigency and must be supported by water storage to be really effective. This water storage should begin in the farmers' brook.

Mr. W. A. Ritter wrote a fine description of Mr. Chas. Call's power plant, published in the Ohio Farmer of July 25th, 1908.

This picture of Mr. Chas. Call's dam, which impounds the water of a brook which you can easily step across, is an illustration of such a development. Two months from the time Mr. George H. Lodge, of Cuyahoga Falls, his son-in-law, started with him to build that dam, they were lighting Mr. Call's house and other buildings by electricity produced by that babbling brook. It is simply an earth dam with a concrete spillway with some stones the farm could well spare for the water to fall upon.

A little brook, yet that great passage way thirty-two feet long

and say two feet high was filled within five inches of its top last Spring; and when I visited his home a few weeks ago, I found Mr. Call had added eighteen inches to the height of his spillway and was scraping the earth in to increase the height of the rest of the dam. He said it was surprising how fast they could fill the dam up in that way. In such work the earth should always be higher than the concrete and the concrete high enough so that the water can never get over its sides, no matter how heavy the flow of water coming down. With these precautions earth dams



Dam of Mr. Charles Call. From "Ohio Farmer."

when properly constructed, especially if they have a diaphragm of concrete deep down and running their whole length and planted with willows are in many places the cheapest and best dams. This dam is over 300 feet long and cost about \$400 to construct. The total equipment about \$1200. A \$60 chandalier shows its elaborateness. When the dam is filled with water it covers about four acres and affords pleasure for boating, swimming and fishing. Under the dam at this point is a sewer pipe eighteen inches in diameter connecting with a rectangular box open at the top and at one side and passing to the lower side of the dam. By lifting

the gates on the front part of this box the pond was emptied of its water to do the work shown and a large quantity of fish revealed. As a matter of fact such a pond properly stocked with fish is capable of yielding more value per acre than the ordinary farm will produce by cultivation.

The power house is shown at the left, in which is a six-horse-power water wheel and five kilowatt dynamo. This furnishes light and runs some small machines. The wheel is started and stopped by a wire running to the house and attached by very in-



House of Mr. Charles Call. From "Ohio Farmer."

genious contrivance to the gate of the water wheel. Mr. Lodge deserves great credit for the ingenuity shown in the installation of this plant. The discharge pipe for overflow and for emptying the pond is shown in this picture, and in front of it in the willows is shown the little brook hardly more than two feet across at that point. Mr. Call says there are seven or eight places on that little stream where other farmers can do as well or better.

It was nice to note the generous credit Mr. Call gave the young men, Messrs. Lodge and Ritter, for the accomplishment of this work, and right here I may say, I believe there is a large field for

competent young men to assist farmers in such developments. There are literally thousands of such opportunities all through the land, and farmers should embrace them without delay. It will mean the aggregate storing of immense quantities of flood waters in the feeders of large streams and enhance the value of such farms from 25% to 50%, to say nothing of the luxury of electric lights and electricity applied to plowing, seeding, reaping, mowing, haying, cultivating and other outside operations, per-



Barns of Mr. Charles Call. From "Ohio Farmer."

formed with the aid of the electric automobile applied to farm uses.

A starter is shown in the haying scene exhibited, and in the same house, washing, ironing, cooking and a multitude of little things where heat is required, as also in many cases heating the house in winter time.

Mr. John T. McDonald, of Delhi, N. Y., has another similar and larger development, being about twenty-five horse power, and in addition to lighting his house and barns he has a shop with saws, planers and special machinery, and finds it very handy on rainy days to spend them in comfort and pleasure with his men in

doing useful work by machinery. This is finely described by Prof. H. L. Bailey, in the *Outlook* for August 25th, 1906.*

He has a model farm in the upper Delaware Valley, says he can develop as much again power as he has now, cuts ice from his.



pond for himself and neighbors (as does Mr. Call previously referred to). There are other such developments in the country to which I need not now refer.

*On returning I visited the farm of Mr. McDonald. There were once eighty-nine saw mills on that little brook, and his is now the only water power development on the stream. It is about 1400 feet above sea level, and the whole upper country of the Delaware and Susquehanna present the most abundant possibilities of lake storage. See map of Banff country, which illustrates it very well, though it is more mountainous than the Delaware country.

These are small beginnings, but they are the forecasts of lots of others, all of which means the conservation of water and the equalization of summer flow.

Nowhere can a like expenditure of money count so much for the comfort and betterment of home life on the farm, and power conditions lower down on the stream.

In early times even small water powers determined the location of places. For years Cleveland, Ohio, was a hamlet near Newburg, the start of the latter being determined by a small water power that is now abandoned.

In many cases ideal sites for power were inadequately developed by the first users, who had power enough for their purposes, and did not, or could not, purchase sufficient land to compass the solution of an ideal site.

At Kent, Ohio, is shown a dam constructed on ideal plans and in an ideal situation, with rock bottom and sides, originally constructed by the State for canal purposes, its use for power being secondary, and no advantage was taken of the opportunity to buy cheap land above for storage purposes. Now the land would cost a great deal, besides a railroad has possession of one of its banks. A beautiful piece of stone channel cutting is shown in making place for the railroad. But for this condition and the high price of land above, this would be an admirable site for larger development and storage of water. The gorge is shown above the dam with its regular sides.

This location is famous for the historic leap of Captain Brady, who in fleeing from the Indians jumped the chasm as they were almost upon him. It was an almost superhuman thing to do, but he was successful and succeeding in hiding himself among logs and lily pads of Brady Lake, while the Indians had to pass around to a ford higher up the stream. Though walking over his head upon the logs they failed to find him.

Cuyahoga Falls also illustrates another inadequate early development of an admirable site. At a suitable time overflow land could have been purchased at a moderate price and a large storage secured between Kent and Cuyahoga Falls. As it was the fall was great and gave them all, and more than all, the power they required.

The next picture shows the three upper dams in succession and the arrangement of flumes and buildings is a fair illustration of

marred natural beauty that make us rejoice that more artistic and beautiful developments are being made to-day. Other parts of the gorge below are very beautiful.

Some years ago a race was started in the gorge to convey water to Akron, about four miles below, where there is a fine head and large water power development. The Salt River Power Canal illustrates the modern construction of such a power canal and shows the great value of concrete construction for such work. In all these there was no conservation of water in any proper sense, and is a fair illustration of the irregularity of river flow without storage reservoirs, and the Cuyahoga is like the majority of streams throughout the country, almost dry at times and surging bank full at other times, when it goes down in such quantity that it can be turned to no useful account, and often carries destruction in its way.

Look at the map of the United States showing the rivers. The lake regions of New York and New England, to a certain extent, conserve water and make more or less valuable water powers, but are by no means adequate and should be both enlarged and increased in numbers to do what is required of them. On the other hand such streams as the Delaware and the Susquehanna are threads of water without lakes, very low in summer and flooded every year with water that ought to be stored in the hills from whence they came. There is abundant opportunity.

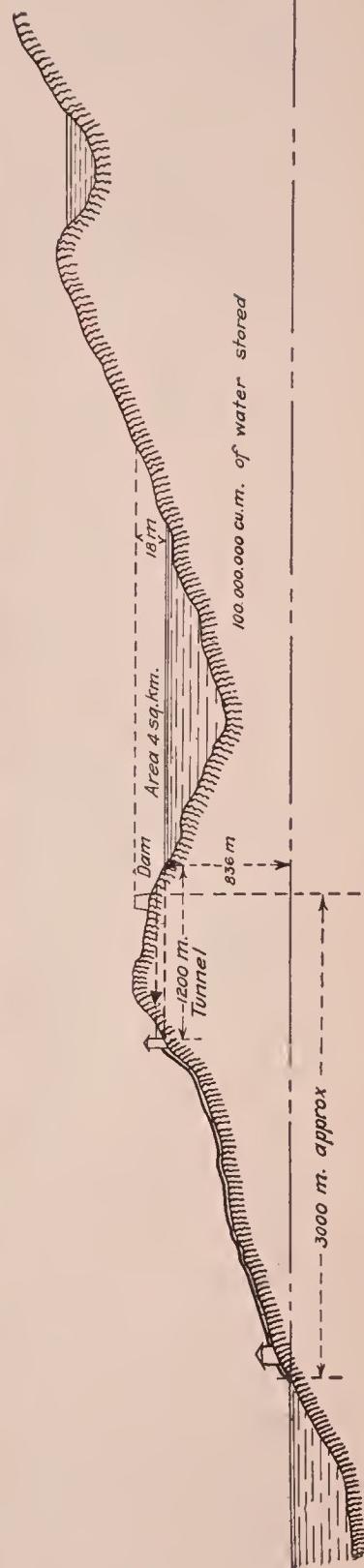
The feeders of the Ohio are largely the same, throwing an aggregate of water into the Ohio, carrying damage and destruction all along their course. This can be saved by reservoirs in the Appalachians.

There is probably not a single year when the flood damage to Pittsburgh does not exceed \$3,500,000, while in the summer boats are loaded with coal and held in the upper waters to be floated at flood down the river. How much better to reforest the hills and impound the water in the ravines and make the Ohio and many of its branches navigable the whole year through, at the same time saving from inundation millions of acres of immensely valuable lowlands of the Mississippi Valley, while lands very much less in value are used in the up-country to store this water, at the same time developing power that is valuable.

The place to hold water back is in the upper parts of the country where land is cheap. A hundred million dollars damage by

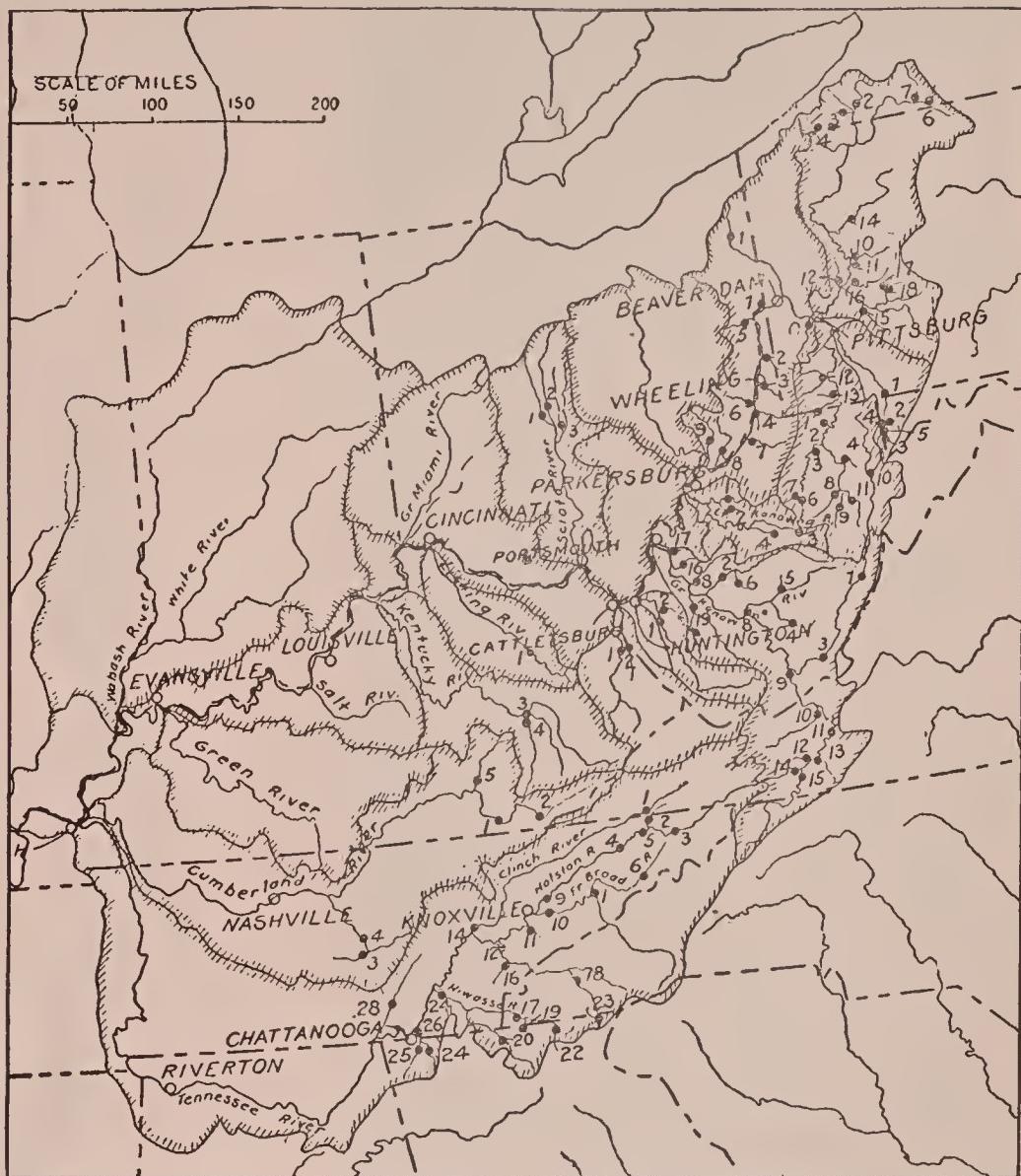


Ideal country in which to build dams, make large lakes and store water.



Ideal water power site in Norway. From "Electrochemical Industry."

flood every year is a high price to pay for our folly. Better pay a portion of that amount per year in making storage for water and reforesting suitable places and develop water power which, in addition to paying for the cost, will save millions of dollars per



Proposed water storage in the Appalachians. From "World's Work."

year in coal. Banff illustrates an ideal country for water storage.

Dr. Putnam, before the Governors' Conference, made clear that 30,000,000 horse power of water can comparatively cheaply be developed in the United States, while the development of 150,000,000 horse power could be practicably considered. When one reflects

that the useful application of one horse power of water per year is the equivalent to saving twelve tons of coal per year, we may well ponder as to the proper utilization of the immense power at our disposal.

As a rule land that is not very valuable may be used for storage purposes, and even if it is valuable, in some cases, would be more valuable for use in impounding water than the uses to which it is now put. Ravines abound and are better so used than not. The dam can be in many cases largely made of stones that



Doe River, Tenn. Ravines for storage and power.
From "Forestry and Irrigation."

now cumber the ground and the farms be the better for their removal.

The Oswego water shed is advantageously situated for such installations and there are literally thousands of farms where this water storage and power can be installed and with it may come the annual saving of thousands of tons of coal, at the same time relieving the finger lakes of much of the strain put upon them in the rainy season.

Many examples of such possibilities could be given, such as

Big Stream, which has its rise in Tyrone, in Schuyler County, at an altitude of about 1100 feet, passing through Yates County into Seneca Lake, through a good farming country, and having a fall of more than six hundred feet in the course of ten or twelve miles. Such a stream as this properly harnessed is capable of doing the ploughing, seeding and harvesting of the farms through which it passes.

Flint Creek, in Yates County, also offers possibilities more pretentious, and has in addition considerable lake storage possibilities that should certainly be investigated. There are several small dams already on this creek, that can without doubt be enlarged and turned to more useful account by means of dynamos.

Kashong Creek passes through a gulley above Bellona, where a large storage pond could be made and a fall of sixty to eighty feet obtained at Bellona, which could be developed to the great advantage of the town, where a twenty-foot head is now developed and runs a grist mill. These are simply spoken of as examples. There are hundreds of similar cases.

There are other respects in which this water shed is unique, in that there are multitudes of deep glens offering heads of from 100 to 300 or 400 feet, and above them gulleys of small value which could be dammed and large quantities of water stored.

One of the most noted of these is Watkins Glen. I speak of this with delicacy. Some people would say, "Would you blemish Watkins Glen with a water power?" I say, no, I would beautify it with a water power. The storage would be all above the Glen where people visit, and enough water could be allowed to pass in the summer over the cascades to be more than equal to the low water of summer, as it is now. There is very large room for ponds, and even lakes, in the upper part of this stream where very large quantities of water could be stored, and the power used at Watkins to very great advantage.

There is a similar Glen at Hammondsport. A power development in a similar glen at Ithaca was made several years ago and has been in successful operation ever since. The secret of making all of these glens successful producers of power is to secure abundant bondage at higher levels. This is probably possible in every one of them in every case with a rock bottom for the foundation of suitable dams.

Little Lake and Lamoke Lake, in Schuyler County, are at an

elevation of 387 feet above Lake Keuka, and only about two miles therefrom. Their outlet could be dammed at Bradford and their level raised and made into one lake seven or eight miles long and about one mile wide with a large power development at Keuka.

As the waters from these lakes now makes its way into the



Pondage site above glen.



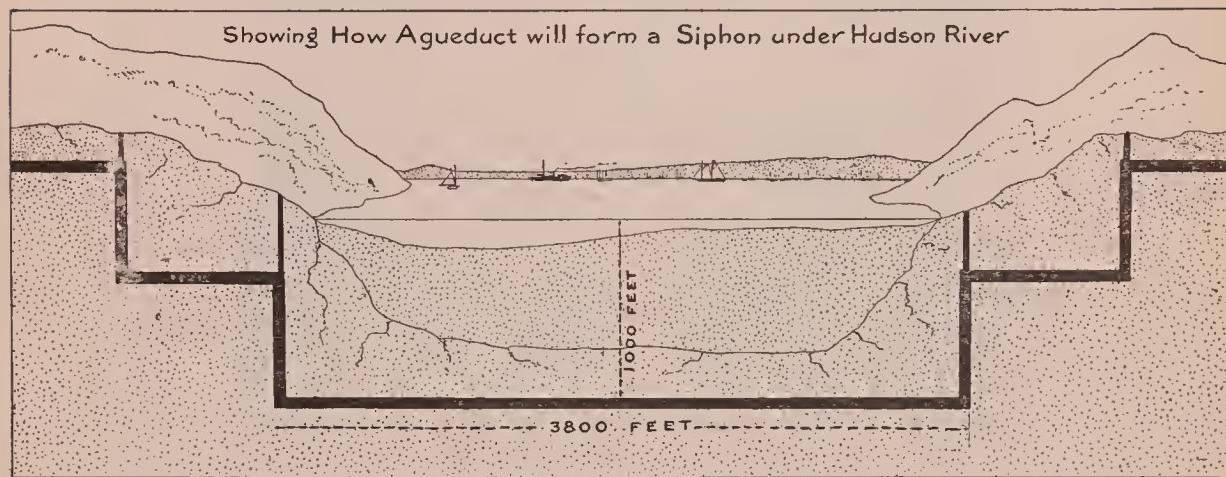
Site for dam above Glen. Taken in dry weather.

Chemung River, a tributary of the Susquehanna, its diversion to the Oswego water shed would have to be made a matter of Inter-State agreement. This raises a very important question, as there is often great advantage, as in this case, to be derived from diverting water from one water shed to another. Where for similar reasons the water can be used to better advantage. Here is a fall

of nearly 400 feet in the space of two miles with a fair supply of water, means a very large power, as 100 pounds per minute means the continuous development at this head of more than one horse power and savings of twelve tons of coal per year for each horse power.



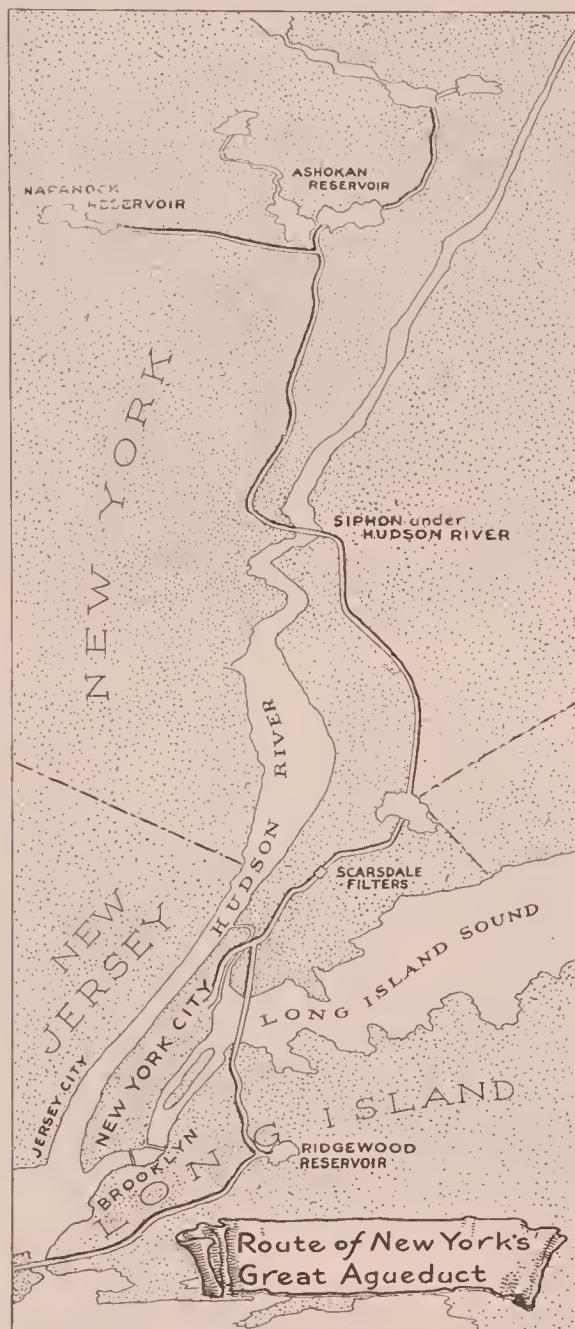
Making concrete aquaduct. New York City Water Supply.



New York City is about to expend \$165,000,000 in storage and conveyance of water from the Catskill Mountains, a distance of eighty-five miles.

This great enterprise includes a great siphon to convey the water under the bed of the Hudson River. There will be a fall

of 610 feet, at least 300 feet of which could be used for power purposes, with the possible development of nearly 35,000 horse power and the saving of 420,000 tons of coal per year. I am indebted to the *Popular Mechanics* for this illustration showing a



map and plan for siphon under the Hudson River and an aqueduct of concrete.

Notwithstanding a fall of more than 100 feet at Rochester, the water is so low in summer in the Genesee that less than

2000 horse power is available, when by proper storage 100,000 horse power would be available the year round at that one point.

It has been proposed to construct a dam at Portage and impound a large quantity of water above the gorge at that point. A map of the proposed lake is made showing the present position of railroad tracks and the position they would occupy when removed to make way for the improvement. This great undertaking is advocated by the New York State Water Supply Commission, and I am indebted to them for the map above referred to. They are also proposing to make a similar storage on the Sacandaga River, north of Albany, in the State of New York.

Four great storage reservoirs and one hundred and thirty-five feet fall of water utilized makes Niagara Falls the seat of power that it is to-day.

The Genesee River might offer the next best power in the State, but it has no important lakes and more than one hundred times as much water passes in flood as at its minimum flow.

Not so with the Oswego River, only about twenty-five times as much water goes through it at flood as at minimum flow.

The storage capacity in what are known as the Finger Lakes of our State make the difference. These are natural reservoirs in a very small measure assisted by dams to retain much of the flood water, with the result that it is probably the more regular water power stream that has its rise in the State; yet under present circumstances it is more than usually pressing that we should ask if the present water storage capacity can be materially increased.

The raising of the dam of Canandaigua Lake would probably be attended with the least trouble and damage. The variation in Canandaigua Lake from highest to lowest water, as I understood, does not exceed five feet, and the spring run-off is always very heavy, and the summer very light.

The dam at Keuka Lake makes the possible difference of level of from six to eight feet from high to low, and there are sometimes as much as two or three feet of water goes to waste over this dam. To raise this dam a few feet and secure a larger supply of flood water, would be attended with some damage, but could be provided for by filling low places and other easements at Hammondsport, Branchport, Penn Yan, and some small places, including cottage sites. But this difficulty is not insurmountable. The dam at the foot of Seneca Lake, I understand, is in bad con-

dition and needs suitable repair to enable Seneca Lake to become the storage reservoir that it is capable of being.

Cayuga Lake is the most difficult to deal with of all the lakes of this system, as it is the lowest of them all. But on the other hand, on account of these very features, it could be made the most



State dam, Keuka Lake. Water low.
This controls the water flow.



Burnt over district, Lake suitable for storage. Level should be raised.
From "Forestry and Irrigation."

valuable of all these lakes for storage purposes, as it constitutes the bottom receptacle of nearly all of them.

This leads us to the question that has greatly troubled our ablest engineers, and I only dare to tread on this ground after them because of its transcendent importance.

I have no doubt but because of this sag the engineers have felt the necessity upon them to step the canal now building down in the vicinity of Newark and up again as it approaches the Rome level. This makes necessary the absorption of a portion of the water of the Oswego water shed for the locking of the canal at this lower level.

The level of the proposed Barge Canal, as it leaves Lake Erie, is 564 feet, and it locks down all the way from there to a point a little east of Rochester. Could the level of the canal from this point be maintained to get over the Rome level, which is 391 feet and 6 inches, the problem of a lock down canal all the way from Lake Erie to the Hudson could be solved.

I do not presume for a moment that all of these questions have not been carefully considered by those in charge of the canal work. But we are now up against conditions that have never before made possible the consideration of things in the large way that is absolutely forced upon us to-day.

The West is calling for the cheapest kind of transportation for its grain and other bulk goods to the Atlantic Ocean. The breaking of bulk where it can possibly be avoided is recognized as a very great disadvantage. A canal for navigation purposes alone only fulfills a part of its possible mission, especially a canal that could be made a lock down canal with the total fall of 564 feet to tide water.

If a ship canal coupled with a water power canal were made between Lake Erie and the Hudson River, the value of the water-power alone would be a very large factor in paying for its enormous cost. It is to be borne in mind in considering such a great proposition, that when once done, as it ought to be done, it will be a continuous source of large income. We are therefore justified in putting the best thought we can conceive upon this important subject and ask ourselves, Is it worth while? Every ton of water per minute that could be made to pass through water-wheels in such a canal to the Hudson River would mean the generation continuously of thirty horse power and the saving of 360 tons of coal per year.

A large development of water power could be made in the vicinity of Lockport, Rochester, Waterloo, Seneca Falls, and from Little Falls to the Hudson River, an enormous development of water power, there being some three hundred feet fall between

these points. We might be justified in such a work for the accomplishment of a great purpose.

Chicago, years ago, found itself in the mud and they assembled as one man and raised those great blocks of buildings and streets, and we have a new Chicago. These were necessities and were done because people had to do them.

The question arises, Is the construction of a ship and power canal from Lake Erie to the Hudson River of sufficient importance to justify the employment of modern means to raise Ithaca and Watkins to a higher and healthier level, and some of the very small places that might be in the way of such a development. These things accomplished the damming of Cayuga Lake opposite Cayuga would make a large storage reservoir of Cayuga Lake



A river on a rampage because it has no storage lakes.
A fair sample of nearly all the rivers in our country.

and enable the level of the canal to be such as to pass the Rome level. A dam across the foot of Cayuga Lake that should have a large spillway and empty the flood water of the watershed into Cayuga Lake would make a large power development possible at Cayuga and equalize the flow of the Oswego River, and thus conserve the flood water of this great and important watershed, and make available the same for the purposes of power and lockage of vessels.

The present Barge Canal is constructed only as a navigation canal, without reference to water power in this electrical age even for the towage of its own boats, and which can be used for that purpose only seven or eight months per year, while the power of a

ship and power canal could be used the whole year through with the production of values running into the hundreds of millions of dollars. It seems passing strange that so important a work should have been undertaken without the coördination of other interests quite as important as those of navigation. All of these interests should work in harmony for the highest possible development of all of our resources as a people.

From the Report to the Governor of the Advisory Board of Consulting Engineers from January 1st, 1907, to January 1st, 1908, page 21, paragraph 4, we take as follows :

"The Board did not feel justified in recommending a generating or transmission system which would allow of possible expansion of power uses for electric haulage or for the sale of surplus power by the State, holding that this was a matter not connected with the appropriation for the construction of water ways."

"The details of power generation for and application to lock mechanism is being given particular study and a set of tentative designs have been submitted to the State Engineers' Department for consideration."

It will be said by many that all this is out of the question. Galveston and Chicago are to-day greater cities than they could have been but for the great work that they have done.

Ithaca can, by modern hydraulic methods, be raised to a proper position, and concrete docks and breakwaters constructed, before which not only the pleasure steamers of Cayuga Lake shall land, but also the commerce of the world. We should not damage Ithaca, but better it beyond its most hopeful thought of the future. We should not damage the water power users of the Oswego watershed, but bless them with reliability of power such as they have never before known, and not have damage suits from them but money instead, for benefits received.

"Albany, Nov. 16.—Fulton Power Company Has Title to Bed of River, Court of Claims Holds in Big Barge Canal Action. State Loses First Phase of Suit for \$3,428,028; May Multiply Canal's Cost Enormously. No Appeal Possible Until Award Fixing Damages has been Reached."

"The State Court of Claims to-day decided against the State in a motion to dismiss the claim of the Fulton Light, Heat and Power Company, of Fulton, Oswego County, for \$3,428,028 for

the permanent appropriation for barge-canal purposes of land in Fulton and of the developed and undeveloped water power in the Oswego River there, together with an alleged depreciation in value of the electric light plant of the company."

The claim, which involves a test case on behalf of power concerns at various points whose water power is to be taken over for canal purposes, was before the court on the issue of the State's ownership of title to the bed of the river and the water rights which the companies are seeking to protect, and the claim has not been tried on the question of the amount of damages sustained by the concern. The decision of the Court of Claims undoubtedly later on will be carried to the Court of Appeals.

In refusing to dismiss the claim, the court holds, in an opinion written by Judge Rodenbeck, in which the other judges concur, that the claimant is the owner of the lands which are to be taken for barge canal purposes, which include the power site of the company at Fulton.

The court agrees with various contentions of law advanced for the claimant, but, under the opinion handed down, has reached no conclusion as to the extent of the riparian rights attaching to the land, which must be determined when the trial is resumed.

Until the case is fully closed, and an award fixing the amount of damages is reached, the State cannot review this determination of the Court of Claims in the higher courts.

The main points covered by the opinion are that a State patent bounded by a fresh water non-tidal stream carries title to the center of the stream; and that a private individual may acquire title by prescription in the bed of such a stream, even though the stream may be navigable.

The far-reaching effect of this decision, if it is sustained, in increasing the cost of the barge canal or other improvements to navigation in this State, cannot be overestimated.

There are a score of other sites like Fulton, at each of which there are a score or more of water power users who will file similar claims in like big amounts. It is understood that these water power users are acting somewhat in concert in furthering the prosecution of the claim now on trial.

Trial of the claim has brought out a notable array of attorneys in behalf of the power companies, headed by Prof. C. A. Collins,

former counsel to Governor Flower. The State was represented by Deputy Attorney-General George P. Decker."

We should make a State canal that should lock all the way down from Lake Erie to the Hudson and that should not be simply a navigation canal but a power canal as well, with its large power at several places already referred to along its course where the grains of the great West could be made into flour and numerous industries dependent upon bulk materials manufactured into goods of higher value, so that even the railroads would rejoice in elevating their tracks and running them alongside this great waterway as they see in prospect the millions of cars of high-class, well-paying freight that they shall be called upon to move from the manufacturers along its banks. Dockage in New York City would be relieved by docks wherever needed along such a canal.

This is not a time for war, but for the coöordination of all the forces of the State, and the United States, for the production of a highway to the sea that shall not only carry the commerce of the world, but by its power, convert untold millions of property from a lower to a higher value.

The great State of New York must get out of a thimble and do things worthy of its name, the great "Empire State." But, as a matter of fact, the State of New York need not do this great work alone. The great West, with Chicago as its spokesman, and even financing, will help in this work as only such people know how to do. Maybe Chicago business men would take the raising of Ithaca as their own responsibility.

Do these great things now, and when the coal mines of Pennsylvania are exhausted, and even long before, our successors shall rise up and call us blessed.

I do not belittle this great undertaking, but the large interests involved are so stupendous that it is necessary to do things wise enough and great enough to coöordinate the whole.

In closing this address, I cannot do better than quote from an address by Mr. McClintock, an eminent engineer, and one of the Canal Commissioners, before business men of Rochester when it seemed certain that a barge instead of a ship and power canal would be built, and also a letter recently received by me from Mr. Lyman E. Cooley, one of Chicago's most eminent engineers, in connection with the drainage canal.

PART OF ADDRESS OF MR. M'CLINTOCK, CANAL COMMISSIONER.

"We demand that the plan adopted shall be one that will give the greatest benefit to the largest number of people. We have studied the surveys made for a ship canal by the way of Lake Ontario, and the various surveys for a barge canal; also the topographical survey of this portion of the State covering the canal which is now complete; also the history of the present canal, and we assert the force of the following propositions:

"1. A barge canal by the way of Lake Ontario would be more for the benefit of Canadian interests than New York.

"2. A barge canal through Rochester and Syracuse would be of no appreciable benefit to any interests in the State except a comparatively small contingent in Buffalo and New York.

"3. It is more than probable that as soon as this State is committed to the construction of a barge canal for 1000 ton barges, work will be begun upon a ship canal from Georgian Bay to Montreal which will give passageway for 8000 ton ships, and such a canal will be finished by the time of the completion of the barge canal.

"4. A ship canal 30 feet deep and 300 feet wide, taking a supply of water from Lake Erie and forming a great navigable river for 350 miles from that lake to the Hudson River is the only scheme that is worthy of consideration by this great State at this stage of its industrial development. Such a canal would be beyond the competition of railroads in the movement of freight. The commerce on it could not be controlled by any combination of ocean steamships or inland railroads, and it can be built so as to make possible the creation of permanent water power worth \$500,000,000, distributed at various points clear across the State.

"Such a canal could be built without increasing the burden of taxation, and be made to pay its cost directly.

"We insist that before the people of this State are asked to vote upon the proposition to spend \$75,000,000 to \$100,000,000 on a barge canal, detailed studies and reports be made upon this project."

21 Quincy St., Chicago, Nov. 2, 1908.

Mr. Edward R. Taylor, Penn Yan, N. Y.

DEAR SIR:—I have yours of the 27th ult. inclosing copy of

your paper read before the Electrochemical Society, which I have read with pleasure. You are thinking along the right lines.

Mr. Geo. W. Rafter did much work in your State on this subject and made some valuable reports.

The project of carrying a supply of water from Lake Erie to the Hudson River was an original idea of Gouverneur Morris, and has been discussed with every change in the canal. The report of the International Commission, of which I was a member, Washington, 1897, submitted profiles of both the Mohawk and Champlain routes, and suggested the cutting out of the Rome summit to the level of Oneida Lake, and the Fort Edward summit to the level of Lake Champlain. These propositions were estimated by the Board of Engineers on Deep Waterways. See their report, 1901.

The West is in favor of the betterment of all water routes to the sea, but the majority of people look upon the barge canal as an improved toll gate for the special benefit of New York State. The West would not assist in asking the General Government for money for the barge canal, but would be very glad to help in securing the additional money which would be required above the cost of the barge canal to make a first-class ship canal. We want thirty feet and not twenty feet when we get ready to break through to the Atlantic.

We shall have a ship route to the Atlantic sooner or later, and so far as the West is concerned, it will go along the line of least resistance, for an outlet to the sea, in our minds, takes supremacy over any question of route.

Yours truly,

LYMAN E. COOLEY.

Referring to Mr. Cooley and the drainage canal: The State of Illinois is about to extend this canal sixty miles, to be a part of "From the Lakes to the Gulf Ship Canal," and Chicago's interest is now centered therein, and it remains to be seen if our slow east has lost its grand opportunity.

It is interesting to note that the stone excavated in making the drainage canal has been found to be worth millions of dollars for concrete and other work. So it might be with a New York ship and power canal in the interest of good roads. Lots of stone, cheap power for crushing and cheap transportation for their use. May we do this great thing.

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